REMARKS

This is a response to the Final Office Action dated June 24, 2005 in which pending Claims 10-18 were rejected under 35 U.S.C. §103(a) as being obvious from Daniels et al. U.S. Patent No. 5,412,913 ("Daniels"). The Examiner alleges that prior art bolts meet the claim limitations of the instant application.

Applicants respectfully traverse. In particular, applicants submit that claims 10-18 include "structural" limitations that "structurally" distinguish the inventive fire resistant structure from prior art structures.

The claims of the instant application require ultra-high-strength bolts, which, as defined in claim 10 and explained in the specification, have a bolt tensile strength of at least 1200 N/mm^2 at a room temperature and a bolt shear proof stress at 650°C satisfying the following inequality:

$$b\Box t \geq \mu \times N_o/(\nu \times bAs),$$

where

b□t is the bolt shear proof stress, such that $b\tau t = TSt / \sqrt{3}$,

TSt is the tensile strength of the bolts at a predetermined high temperature,

μis a coefficient of slip at the room temperature,

N_o is a design bolt tension,

ν is safety factor for a long-term load, and

bAs is a cross-sectional area of a bolt shank.

As explained in ¶¶ [0095] - [0108] of the specification, N_o is determined by a function of room temperature tensile strength of a bolt according to the equation, N_o = 0.675xTSxbAe, where TS is tensile strength of the bolt at Room temperature, and bAe is the

effective cross-section area of the bolt thread. Also, a typical coefficient of slip (μ is, for example, 0.45, and a typical safety factor for long term load (ν) is, for example, 1.5. Then, the above equation can be expressed as

b□t (shear proof stress) ≥ 0.2025 x TS x (bAe/bAs).

Since the claims explicitly require a bolt to have room temperature tensile strength of at least 1200 N/mm^2, the above equation can be expressed again as follows:

b□t (shear proof stress) ≥ 243 x (bAe/bAs).

Applicants note that the effective cross-sectional area (bAe/bAs) of the bolt thread portion of the inventive bolts over the cross sectional area of the bolt shank is greater than that of conventional general bolts and conventional fire resistant bolts (e.g., general F10T bolts and fire resistant F10T bolts) for the same bolt size (e.g., M16, M20, M22 and M24 industrial sizes).

That is the value of (bAe/bAs) for the claimed bolts is 0.816 for industrial sizes M16, M20, and M24, and is 0.832 for industrial size M22. (See e.g., specification ¶ [0108]). In contrast, the value of (bAe/bAs) for conventional general F10T bolts and fire resistant F10T bolts is 0.780 for industrial standard sizes of M16, M20 or M24, and is 0.797 for industrial size M22.

As is understood from the above, the claimed ultra-high-strength "fire-resistant" bolts are clearly characterized by enhancing shear proof stress of the bolt at high temperature by making the value of (bAe/bAs) larger than that of conventional (general of fire resistant) F10T bolts, and by requiring a room temperature tensile strength of greater than 1200N/m2 as recited in the claims.

Figure 8 compares the shear proof stress of an ultra-high strength bolt made according to the present invention with the shear proof stress of a conventional general F10T bolt and of a conventional fire resistant F10T bolt, where all bolts are made according to the industrial standard size of M22 bolts. At 650 °C, the ultra-high-strength bolt made according to the

invention has the shear proof stress of 236 N/mm^2, which meets the claimed condition. Meanwhile, the shear proof stresses of the other conventional bolts are less 200 N/mm^2 and do not meet the claimed relationship.

Moreover, the ultra-high-strength bolt having the elevated shear proof stress allows higher long term allowable shear force of beam as shown in Table 3. For example, the comparative examples with two bolts in floor slab on upper flange side of beam can withstand only up to 557 KN of shear force of beam with regular F10T bolts and 620 KN with fire resistant F10T bolts. However, the example with the instant ultra-high-strength bolts can hold up to 800 KN of shear force of beam. Similarly, bolt-connected structures with the conventional bolts and fire resistant bolts having four bolts in floor slab on upper flange side of beam can withstand only up to 1023 KN and 1096 KN of shear stress respectively. Meanwhile, the bolt-connected structure with the ultra-high-strength bolts having four bolts in floor slab on upper flange side of beam can withstand up to 1420 KN of shear stress. Thus, a high-strength bolted connection structure with steel beams and columns connected with the ultra-high-strength bolts can withstand higher shear force caused by fire than what the conventional structures can.

The claimed bolt limitations are not shown, taught or suggested by Daniels. Daniels discloses an improved self-aligning joint, which allows easier and faster installation of individual columns. The invention of Daniels does not require any special bolts to use or practice the self-aligning joints. Since Daniel does not show, teach or suggest employing any special bolts, one of skill in the art would have merely used conventional bolts as available to them to practice Daniels' invention. These conventional bolts, as explained above and shown in the specification, do not meet applicants' claim limitations. Moreover, nothing in Daniels teaches or suggests one of skill in the art to modify or replace the conventional bolts with the inventive ultra-high-strength

bolts having elevated shear proof stress according to the conditions specified in applicants' claims. Accordingly, claims 10-18 are not obvious from Daniels.

Kind consideration of the amendments and the arguments and allowance of all pending claims are respectfully requested.

A petition for one month extension and a check of $120 for the extension fee are enclosed. However, if there is any additional fee due, the Commissioner is hereby authorized to charge payment of any fees required in connection with this submission to Deposit Account No. 02-4377.

Respectfully submitted,

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